Roanoke County 2009 ICLEI Community Carbon Emissions and Energy Summary

This is the third year of tracking greenhouse gas emissions and the total carbon footprint for Roanoke County in 2009 was calculated to be just below 1.85 million tons, an increase of 0.6% from the 1.84 million tons of the baseline year 2007. The methodology for this analysis is the same as in past years with the exception of the Roanoke Valley Resource Authority (RVRA) waste data for the Smith Gap Landfill. For 2009, the compiled landfill waste data from the RVRA was split between the City of Roanoke and Roanoke County (including Vinton). Municipal waste data indicate 51.4% of the waste by mass originated in the City and 48.6% of the waste originated from Roanoke County and the Town of Vinton. In past years, only municipal waste was counted, but this assumption was revised this year to account for all wastes going to Smith Gap Landfill. These same jurisdictional percentages were applied to the other waste types, for example commercial, for a total of 72,787 short tons of waste attributed to the County. For proper comparison, the 2007 baseline waste values were also adjusted from the original 2007 report to account for this new data which increases the waste tonnage from 46,736 to 77,419 short tons assuming a 50/50 waste split in the 2007 cases since more detailed data was not compiled.

The greenhouse gas emission values were determined by entering energy/fuel consumption information supplied by American Electric Power (AEP), Roanoke Gas, VDOT, (total vehicle miles travelled in the County), and other available pertinent fuel and energy data into ICLEI CACP, version 1.1 June 2005, software. Fuel oil and propane values were not updated for 2009 since more accurate data is not available.

The values in Table 1 for emissions of carbon dioxide, sulfur dioxide, and nitrogen oxides for electricity were provided by AEP and used in the CACP Software for the calculations of Greenhouse Gases (GHGs) and Criteria Air Pollutants (CAPs). Note the increase in the carbon dioxide emission coefficient by 7.6% and the decrease in the NOx and SOx emission coefficients. The former is due to the use of more coal in the 2009 fuel mix.

Table 1 – Electrical power generation emission coefficients

Emission Chemical(s)	2007 Baseline Coefficients (lbs/kWh)	2009 Coefficients (lbs/kWh)
CO_2	1.70	1.83
NO_x	0.003	0.0013
SO_x	0.009	0.0065

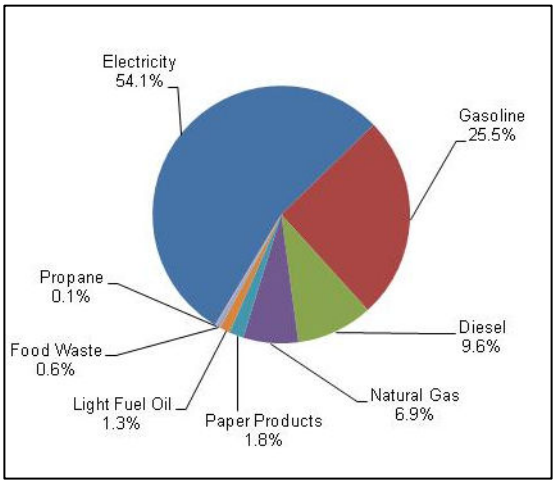
The composition of Roanoke County's carbon footprint when viewed by energy source is shown in Table 2 and Figure 1. It can be seen that electricity plays a disproportionately large role in the local carbon footprint because:

- Over 88% of Roanoke County's electric power is derived from burning coal.
- Coal emits about twice as much carbon dioxide per unit of energy as natural gas.
- Coal emits about 50% more carbon dioxide than gasoline per unit of energy.

Table 2 – Roanoke County 2009 Carbon Emissions and Energy by Source

Source	Equiv CO_2 Tons	Equiv CO_2 %	Energy (Million Btu)
Electricity	1,001,144	54.1%	3,720,039
Gasoline	472,468	25.5%	5,534,588
Diesel	177,673	9.6%	2,048,093
Natural Gas	128,021	6.9%	2,072,126
Paper Products	33,477	1.8%	
Light Fuel Oil	24,250	1.3%	293,359
Food Waste	10,689	0.6%	
Propane	2,113	0.1%	29,187
Plant Debris	-1,175	0.0%	
Wood/Textiles	-706	0.0%	
Totals	*1,847,954*	*100.0%*	*13,697,392*

Figure 1 – Roanoke County 2009 Carbon Emissions by Source

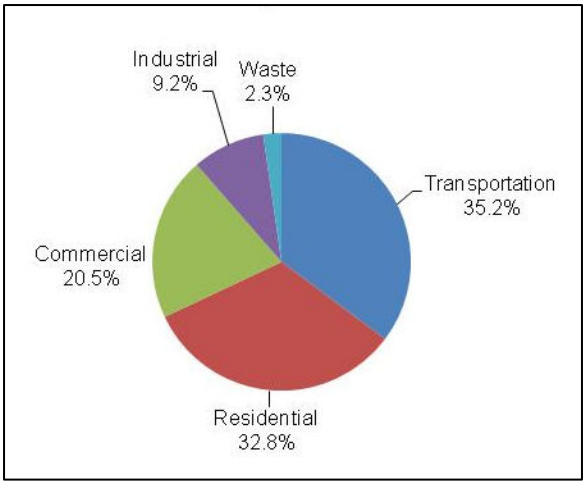


When viewed by contributing sector in table 3 and figure 2, Transportation fuel usage is the largest contributor of CO_2 by a small margin over Residential energy consumption which is followed by Commercial usage and Industrial emissions a distant 4th. Methane gas resulting from decomposition of organic waste material in landfills contributes the least in this analysis. It is revealing to note that while the Residential sector contributes nearly as much CO_2 as Transportation, but uses less than half of the energy of the transportation sector.

Table 3 – Roanoke County 2009 Carbon Emissions and Energy by Sector

Sector	Equivalent CO_2 (Short Tons)	Equiv CO_2 (%)	Energy (million Btu)
Transportation	650,141	35.2	7,582,681
Residential	606,746	32.8	3,465,848
Commercial	379,649	20.5	1,799,322
Industrial	169,133	9.2	849,542
Waste	42,286	2.3	na
Totals	1,847,954	100	13,697,393

Figure 2 – Roanoke County 2009 Carbon Emissions by Sector



The County government operation's carbon footprint was not measured in detail in this analysis since it has been such a small fraction of the total in years past.

Conclusions

As can be seen from the table 4 there have been year-to-year changes in carbon emissions between sectors for the County with some increases and decreases each year. Of most importance is the fact that GHG emissions have gone up in 2009 from 2007 by 0.6% after a slight decrease in 2008. The biggest increase in emissions is seen in the Industrial sector which may be a result of the slight improvement of the economy since 2007. Other sectors are either down or very slightly up from the baseline. The waste comparison change percentage is slightly less accurate due to the change in analysis methods this year.

Table 4 - Comparison of Greenhouse Gas Emissions by Sector and Year

Equivalent CO_2 (Tons)	2007	2008	2009	% Change (2009 vs. 2007)
Transportation	663,960	653,904	650,141	-2.1%
Residential	597,468	588,688	606,746	1.6%
Commercial	364,327	363,527	379,649	4.2%
Industrial	166,097	170,194	169,133	1.8%
Waste	44,977	44,819	42,286	-6.0%
Totals	1,836,829	1,821,132	1,847,955	0.6%

Another important way of comparing the 2009 GHGE to the baseline year of 2007 is by the fuel or energy source used in the community and the quantity of GHGE each produced. Table 5 illustrates the relative change in the four major emission sources.

Table 5 - Comparison of Greenhouse Gas Emissions by Source and Year

Equivalent CO_2 Tons	2007	2008	2009	% Change (2009 vs. 2007)
Electricity	975,906	964,706	1,001,144	2.6%
Gasoline	473,054	471,799	472,468	-0.1%
Diesel	190,906	182,105	177,673	-6.9%
Natural Gas	125,623	131,340	128,021	1.9%
All Others	71,340	71,182	68,648	-3.77%
Totals	1,836,829	1,821,132	1,847,954	0.6%

It can be seen that the CO_2 emissions from electricity are up slightly from the baseline. Electrical usage in terms of kilowatt hours are actually down from the baseline by 4.7%, however the 7.6% increase in the carbon emissions coefficient resulting from the AEP fuel mix results in an overall slight increase in emissions from electricity. Emissions from gasoline are down slightly and diesel somewhat more at -6.9%. Increased emissions from natural gas in the period would suggest increased heating load which matches the colder 2009 winter with 3893 Heating Degree Days (HDD) compared to 3666 in 2007. However, natural gas emissions are lower than expected just based on temperatures so other factors are playing a role.

The increase in CO_2 emissions for 2009 is a small setback with regard to Roanoke County achieving its stated target of 3% per year reduction in CO_2 from 2010 to 2020. Greenhouse gas emissions totals for 2010 will be calculated as soon as possible in the coming year to determine if this trend is continuing.